Web 2.0 Attacks - Next Generation Threats on the Rise

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- **Founder & Director**
  - Blueinfy Solutions Pvt. Ltd. (Brief)
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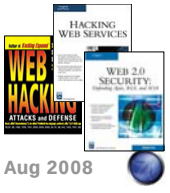
- **Past experience**
  - Net Square, Chase, IBM & Foundstone
- **Interest**
  - Web security research
- **Published research**
  - Articles / Papers – Securityfocus, O'erilly, DevX, InformIT etc.
  - Tools – wsScanner, scanweb2.0, AppMap, AppCodeScan, AppPrint etc.
  - Advisories - .Net, Java servers etc.
- **Books (Author)**
  - Web 2.0 Security – Defending Ajax, RIA and SOA
  - Hacking Web Services
  - Web Hacking

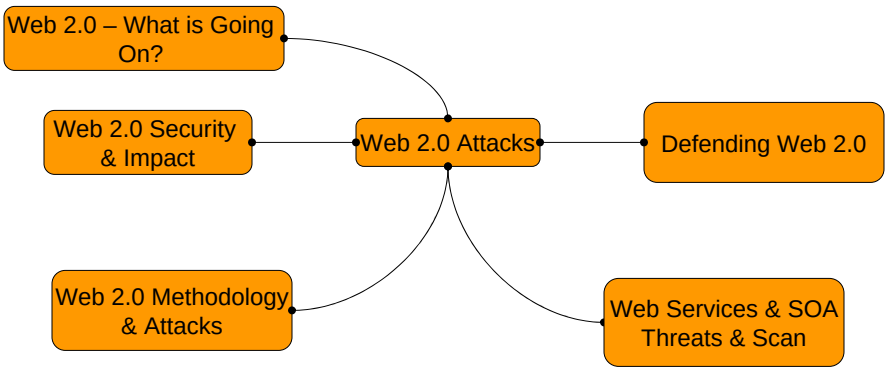
Blueinfy Securityexposure Strategic Security Solutions



Web 2.0 Case – Eye Opening Findings

- Web 2.0 Portal – Buy / Sell
- Technologies & Components – Dojo, Ajax, XML Services, Blog, Widgets
- Scan with tools/products **failed**
- Security issues and hacks
  - SQL injection over XML
  - Ajax driven XSS
  - Several XSS with Blog component
  - Several information leaks through JSON fuzzing
  - CSRF on both XML and JS-Array
    - » HACKED
    - » DEFENSE

Agenda



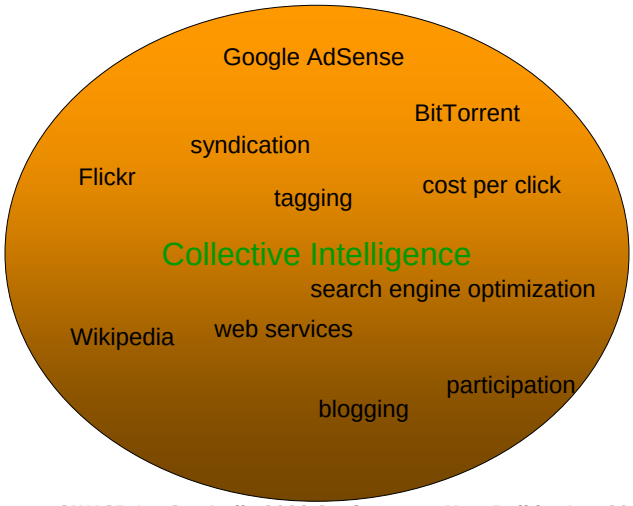
Questions for Next Generation Applications?

- Where is your business logic resides? – Client side...
- Your Web 2.0 framework running on JavaScript, Flash/Flex or Silverlight is secure or not?
- Why are you moving from 1.0 to 2.0?
- Your feeds are secure or not?
- How much data you are using in your app from un-trusted sources?
- Are your end user secure against attacks on your application?

Where are we moving?

- 80% of companies are investing in Web Services as part of their Web 2.0 initiative (McKinsey 2007 Global Survey)
- By the end of 2007, 30 percent of large companies have some kind of Web 2.0-based business initiative up and running (Gartner)
- 2008. Web Services or Service-Oriented Architecture (SOA) would surge ahead. (Gartner)
- Several applications are moving towards Web 2.0 and India is not an exception.
- Off shore development for Web 2.0 on the rise and secure coding around Web 2.0 application is very important.

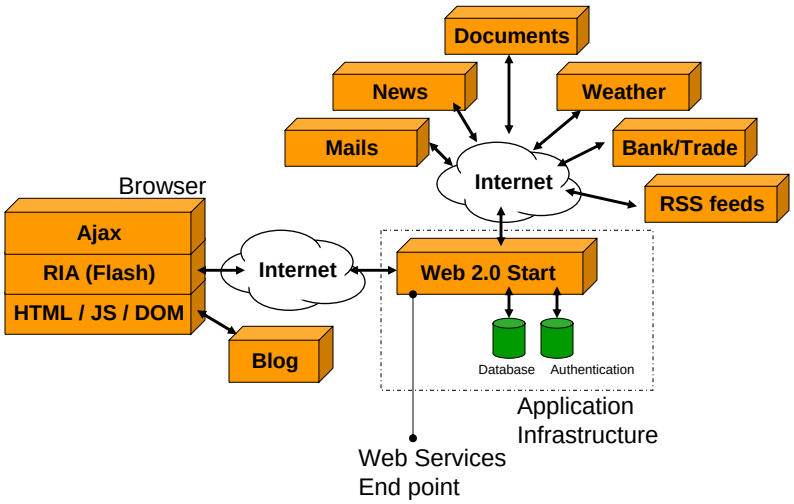
Web 2.0 – People driven shift…



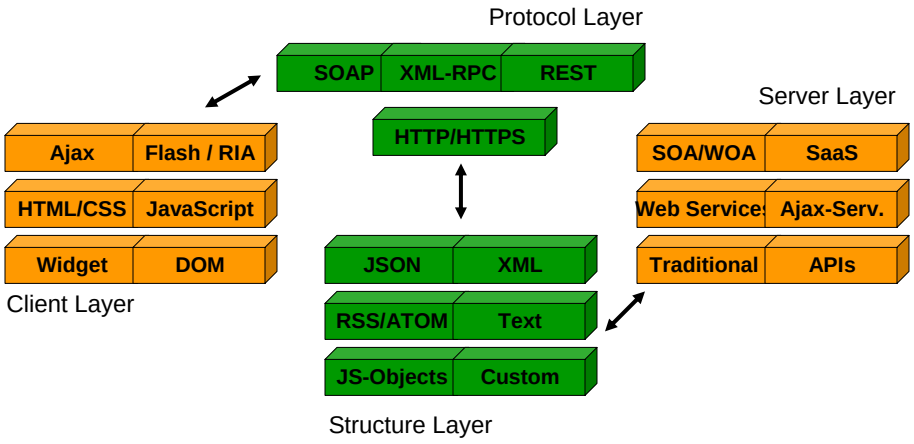
Web 2.0 Technology Perspective

- It is combination of technology – Ajax, RIA, SOA, REST etc…
- Internet – Network of Networks
- Web 2.0 – Application of Applications
- Internet itself is becoming a platform and applications are emerging as objects residing on it and building a large distributed framework
- Google, Yahoo, eBay, Amazon etc. are providing APIs for access – boosting

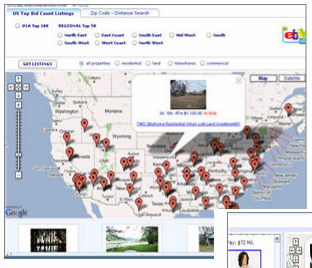
Web 2.0 Architecture



Web 2.0 Components



Web 2.0 Samples



Click stars to vote

Description
Live eBay Real Estate listings with Google Maps. Includes USA Top 100 Bid Count List, along with regional Top 50 Lists.

APIs eBay + Google Search
Tags auction, mapping, realestate

Added 02 Nov 2005
Who Tuan Le
URL http://www.2RealEstateAuction ...

Click stars to vote

Description
Map of Forbes list of the top 100 most powerful and best paid celebrities. Pop-up windows for each includes related YouTube videos.

APIs Google Maps + Yahoo Geocoding + YouTube
Tags celebrities, fun, mapping, money, video

Mashup of the Day
Added 23 Jul 2007
Who mibazaar [Profile]
URL http://www.mibazaar.com/top10 ...

See Related Mashups

Top 10 African Americans in Hollywood

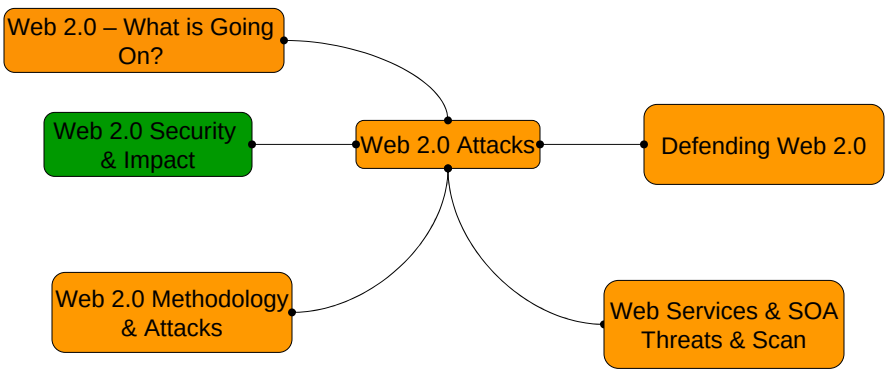
Enterprise 2.0

- Web 2.0 is not restricted to just social platform
- Penetrating into corporate
- Known as Enterprise 2.0
- Old generation applications are changing across companies

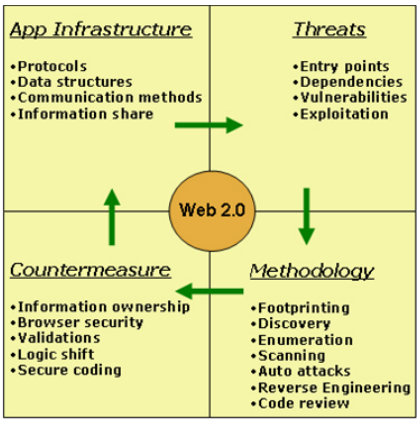
Enterprise 2.0

- Enterprise mashup
  - Enterprise runs services in its own mashup
  - Web based enterprise solutions
  - $700 million industry (2013) - Forrester
  - Databases get converted to RSS
  - Emerging strategies around 2.0
  - SOA mashups
  - Etrade, IBM, Wells Fargo – examples

Agenda



Impact of Web 2.0



Impact of Web 2.0

- Application Infrastructure

Vector	Web 1.0	Web 2.0
Protocols	HTTP & HTTPS	SOAP, XML-RPC, REST etc. over HTTP & HTTPS
Information structures	HTML transfer	XML, JSON, JS Objects etc.
Communication methods	Synchronous Postback Refresh and Redirect	Asynchronous & Cross-domains (proxy)
Information sharing	Single place information (No urge for integration)	Multiple sources (Urge for integrated information platform)

Impact of Web 2.0

■ Security Threats

Vector	Web 1.0	Web 2.0
Entry points	Structured	Scattered and multiple
Dependencies	Limited	• Multiple technologies • Information sources • Protocols
Vulnerabilities	Server side [Typical injections]	• Web services [Payloads] • Client side [XSS & XSRF]
Exploitation	Server side exploitation	Both server and client side exploitation

Impact of Web 2.0

■ Methodology

Vector	Web 1.0	Web 2.0
Footprinting	Typical with "Host" and DNS	Empowered with search
Discovery	Simple	Difficult with hidden calls
Enumeration	Structured	Several streams
Scanning	Structured and simple	Difficult with extensive Ajax
Automated attacks	Easy after discovery	Difficult with Ajax and web services
Reverse engineering	On the server-side [Difficult]	Client-side with Ajax & Flash
Code reviews	Focus on server-side only	Client-side analysis needed

Impact of Web 2.0

- Countermeasure

Vector	Web 1.0	Web 2.0
Owner of information	Single place	Multiple places [Mashups & RSS]
Browser security	Simple DOM usage	Complex DOM usage
Validations	Server side	Client side [incoming content]
Logic shift	Only on server	Client side shift
Secure coding	Structured and single place	Multiple places and scattered

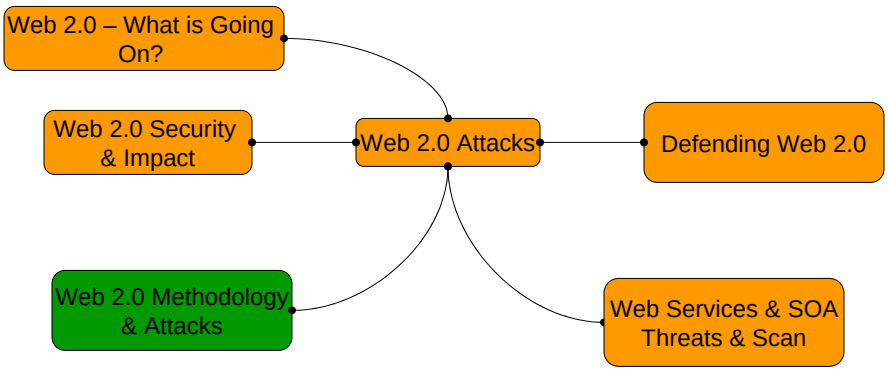
Web 2.0 Security

- Complex architecture and confusion with technologies
- Web 2.0 worms and viruses – Sammy, Yammaner & Spaceflash
- Ajax and JavaScripts – Client side attacks are on the rise
- Web Services attacks and exploitation
- Flash clients are running with risks

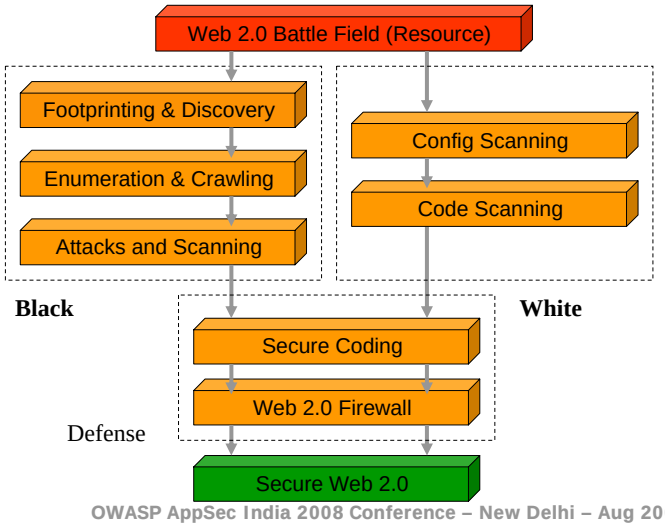
Web 2.0 Security

- Mashup and un-trusted sources
- RSS feeds manipulation and its integration
- Single Sign On and information convergence at one point
- Widgets and third-party components are bringing security concerns
- Old attacks with new carriers

Agenda



Methodology, Scan and Attacks



Fingerprinting

- Application fingerprinting – identifying web and application servers
- Ajax and RIA framework fingerprints
- Getting hold on to technologies – WebLogic or Tomcat, Atlas or Dojo
- Helps in assessment and mapping publicly known vulnerabilities

Discovery

- Ajax running with various different structures
- Developers are adding various different calls and methods for it
  - JSON, Array, JS-Object etc.
- JavaScript can talk with back-end sources
- Mashups application talking with various sources
- It has significant security impact
- Identifying and Discovery of structures

Crawling & Enumeration for Web 2.0

- Dynamic page creation through JavaScript using Ajax
- DOM events are managing the application layer
- DOM is having clear context
- Protocol driven crawling is not possible without loading page in the browser

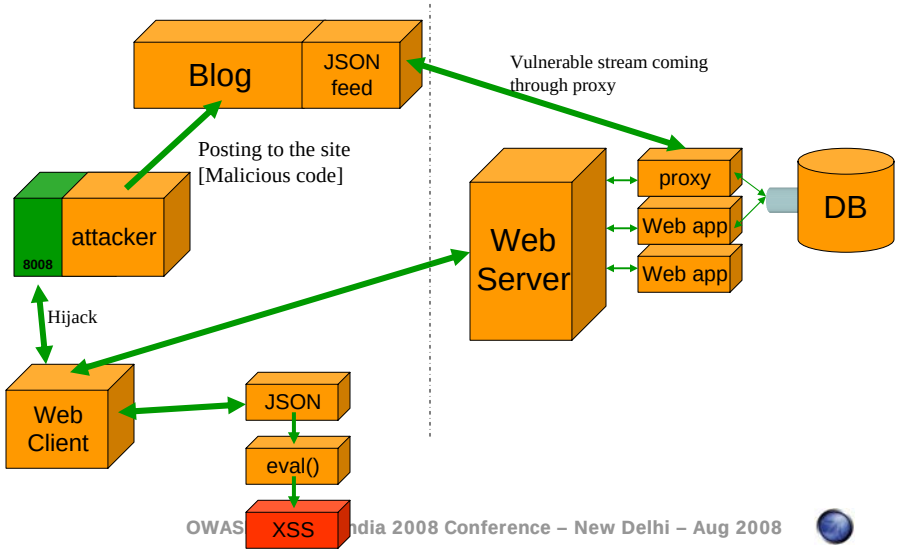
Cross Site Scripting (XSS) – 2.0 Style

- What is different?
  - Ajax calls get the stream
  - Inject into current DOM using eval() or any other means
  - May rewrite content using document.write or innerHTML calls
  - Source of stream can be un-trusted
  - Cross Domain calls are very common

Addressing Cross Domain Calls

- Cross Domain calls are very important for Web 2.0 applications.
  - Proxy to talk with cross domain
  - Callback implementation to fetch them
  - Flash via crossdomain.xml
- These are types of bypass and can have security implications
- Source of the information – key!

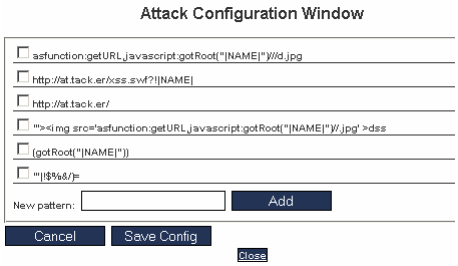
Scenario



XSS with RIA

- Applications running with Flash components
- getURL – injection is possible
- SWFIntruder
- Flasm/Flare

(http://www.nowrap.de/)



Scanning for XSS

- Scanning Ajax components
- Retrieving all JS include files
  - Part of <SCRIPT SRC=….>
- Identifying XHR calls
- Grabbing function
- Mapping function to DOM event
- Scanning code for XSS – look for eval() and document.write()

Ajax serialization issues

- Ajax processing various information coming from server and third party sources. – XSS opportunities

JS – Object

```
message = {
        from : "john@example.com",
        to : "jerry@victim.com",
        subject : "I am fine",
        body : "Long message here",
        showsubject :
function(){document.write(this.subject)}
};
```

JSON issues

```
{"bookmarks":[{"Link":"www.example.com","D
esc":"Interesting link"}]}
```

```
new Array(“Laptop”, “Thinkpad”, “T60”,
“Used”, “900$”, “It is great and I have
used it for 2 years”)
```

JS – Array manipulation

Countermeasures

- Client side code audit is required
- XHR calls and DOM utilization needs to be analyzed
- Content from un-trusted information sources should be filtered out at proxy layer
- Cross Domain Callback – careful
- Browser side content validation before consuming into DOM

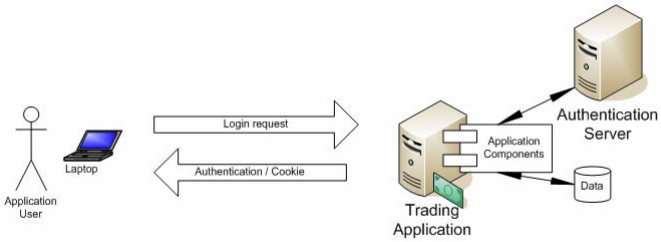
Cross Site Request Forgery (CSRF)

- Generic CSRF is with GET / POST
- Forcefully sending request to the target application with cookie replay
- Leveraging tags like
  - IMG
  - SCRIPT
  - IFRAME
- Not abide by SOP or Cross Domain is possible

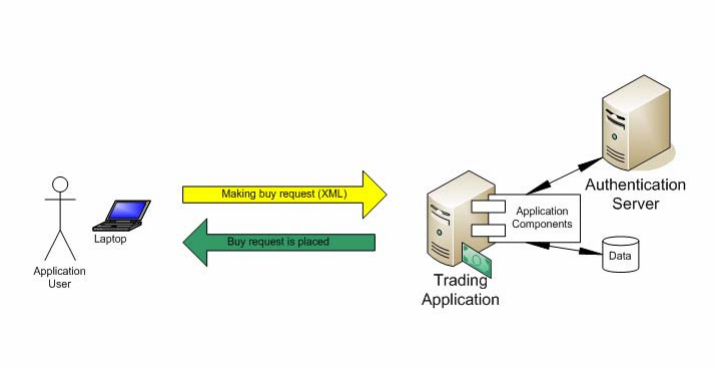
Cross Site Request Forgery (CSRF)

- What is different with Web 2.0
  - Is it possible to do CSRF to XML stream
  - How?
  - It will be POST hitting the XML processing resources like Web Services
  - JSON CSRF is also possible
  - Interesting check to make against application and Web 2.0 resources

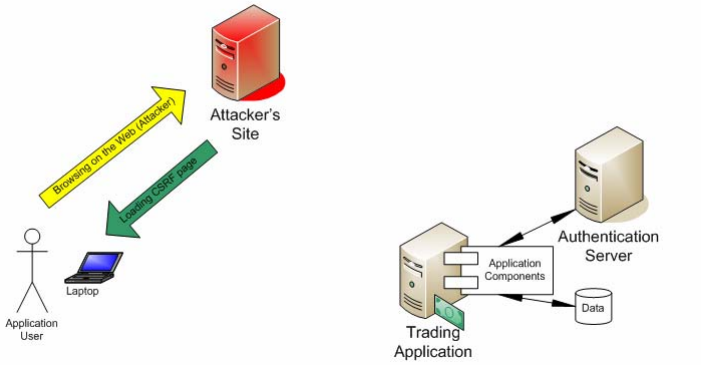
One Way CSRF Scenario



One Way CSRF Scenario

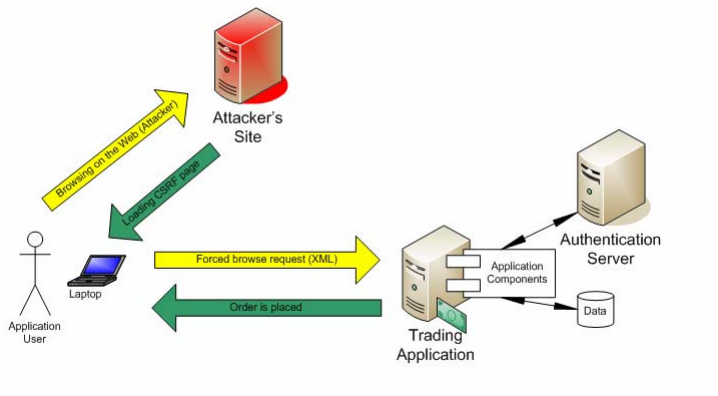


One Way CSRF Scenario



One Way CSRF Scenario

Demo



One-Way CSRF

```
<html>
<body>
<FORM NAME="buy" ENCTYPE="text/plain"
    action="http://trade.example.com/xmlrpc/trade.rem" METHOD="POST">
      <input type="hidden" name='<?xml version'
    value='"1.0"?><methodCall><methodName>stocks.buy</methodName><
    params><param><value><string>MSFT</string></value></param><pa
    ram><value><double>26</double></value></param></params></met
    hodCall>'>
</FORM>
<script>document.buy.submit();</script>
</body>
</html>
```

- Splitting XML stream in the form
- Possible through XForms as well
- Similar techniques is applicable to JSON as well

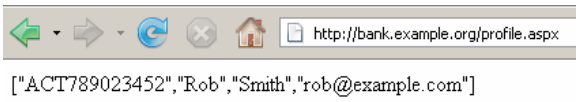
Two-Way CSRF

- One-Way – Just making forceful request.
- Two-Way
  - Reading the data coming from the target
  - May be getting hold onto important information – profile, statements, numbers etc.
  - Is it possible with JSON/XML

Two-Way CSRF

Two-Way CSRF

- Application is serving various streams like – JSON, JS-Object, Array etc.



- Attacker page can make cross domain request using SCRIPT (firefox)
- Following code can overload the array stream.

```
function Array()
{ var obj = this; var index = 0; for(j=0;j<4;j++){ obj[index++]
setter = spoof; } } function spoof(x){ send(x.toString()); }
```


Countermeasure

- Server Side Checks
  - Check for client's content-type
  - XHR calls – xml/application
  - Native calls – text/html
  - Filtering is possible on it
- Client Side Checks
  - Stream can be started and terminated by /* or any predefined characters
  - Client can remove them before injecting to DOM

Web 2.0 Components

- There are various other components for Web 2.0 Applications
  - RSS feeds
  - Mashups
  - Widgets
  - Blogs
  - Flash based components

RSS feeds

- RSS feeds coming into application from various un-trusted sources
- Feed readers are part of 2.0 Applications.
- Vulnerable to XSS
- Malicious code can be executed on the browser.
- Several vulnerabilities reported

Mashups

- API exposure for Mashup supplier application
- Cross Domain access by callback may cause a security breach
- Confidential information sharing with Mashup application handling needs to be checked – storing password and sending it across (SSL)
- Mashup application can be man in the middle so can't trust or must be trusted one

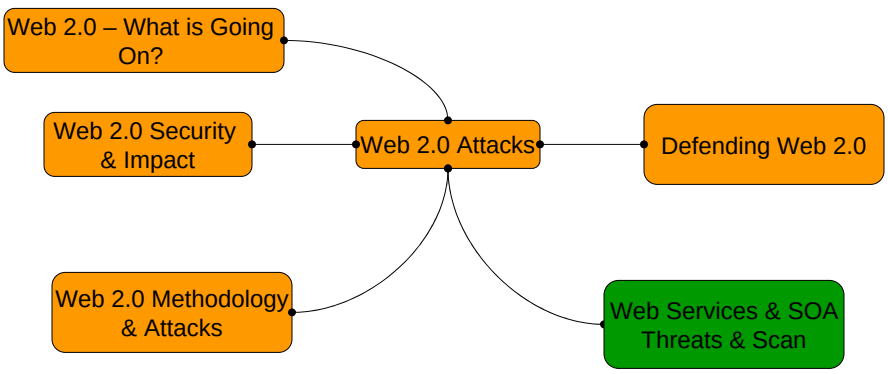
Widgets/Gadgets

- DOM sharing model can cause many security issues
- One widget can change information on another widget – possible
- CSRF injection through widget code
- Event hijacking is possible – Common DOM
- IFrame – for widget is a MUST

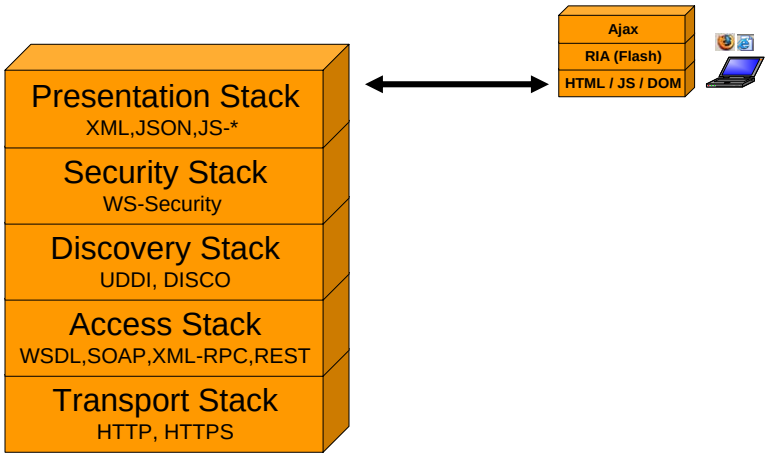
Blogs

- Blogs are common to Web 2.0 applications
- Many applications are plugging third party blogs
- One needs to check these blogs – XSS is common with blogging applications
- Exceptions and Search are common XSS points

Agenda



SOA Stack



Primary Discovery

- Crawling the application and mapping file extensions and directory structures, like ".asmx"
- Page scrubbing – scanning for paths and resources in the pages, like atlas back end call to Web Services
- Recording traffic while browsing and spidering, look for XML based traffic – leads to XML-RPC, REST, SOAP, JSON calls

Secondary Discovery

- Searching UDDI server for Web Services running on particular domain
  - Three tactics for it – business, services or tModel
- Running queries against search engines like Google or MSN with extra directives like “inurl” or “filetype”
  - Look for “asmx”
- wsScanner – Discovery!

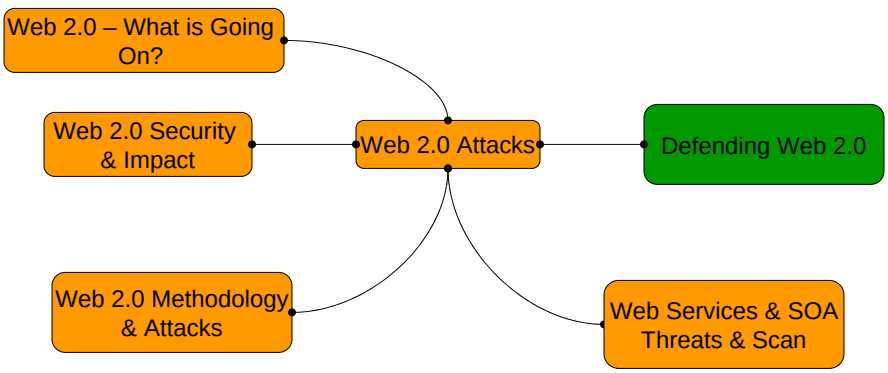
Enumerating and Profiling

- Fingerprinting .Net framework and Client side technologies – Dojo or Atlas ...
- Scanning WSDL
  - Looking for Methods
  - Collecting In/Out parameters
  - Security implementations
  - Binding points
  - Method signature mapping

Scanning strategies

- Manual invocation and response analysis
- Dynamic proxy creation and scanning
- Auto auditing for various vectors
- Fuzzing Web Services streams – XML or JSON
- Response analysis is the key
  - Look for fault code nodes
  - Enumerating fault strings
  - Dissecting XML message and finding bits
  - Hidden error messages in JSON

Agenda



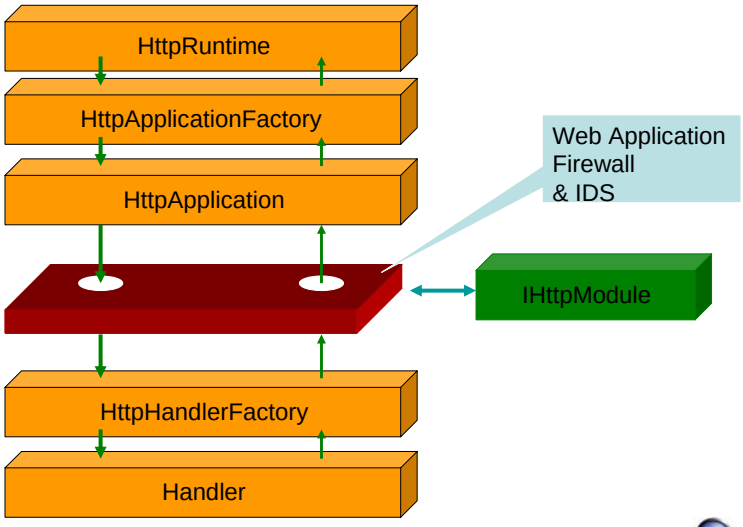
Code Analysis for Web 2.0

- Scanning the code base
- Identifying linkages
- Method signatures and inputs
- Looking for various patterns for SQL, LDAP, XPATH, File access etc.
- Checking validation on them
- Code walking and tracing the base - Key

Content filtering with 2.0

- Regular firewall will not work
- Content filtering on HTTP will not work either since it is SOAP/JSON over HTTP/HTTPS
- SOAP/JOSN level filtering and monitoring would require
- ISAPI level filtering is essential
- SOAP/JSON content filtering through IHTTPModule

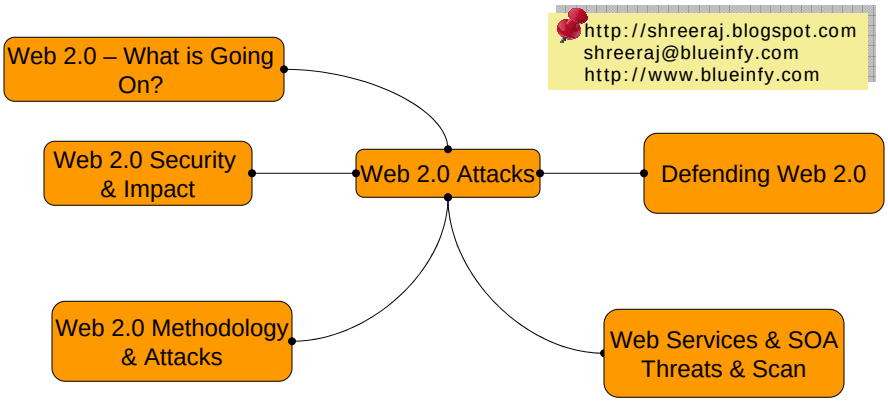
HTTP Stack for .Net (IIS6/7)



Conclusion

- Web 2.0 bringing new challenges
- Needs to adopt new methodologies for scanning
- Attacks and entry points are scattered and multiple
- Ajax and SOA are key components
- WAF and Code review are important aspects for Web 2.0 defense

Question & Thanks!



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